Study Programme	Mechanical Engineering
Qualifications awarded	First degree
Professional title	Bachelor (appl.) in Mechanical Engineering
Number of ECTS credits	180
Level of qualification according to the National Qualification Framework and the European Qualifications Framework	VS-1 (NQF) First cycle (EQF)
Field of study	Engineering and technology
Mode of study	Full-time
Language of instruction	Serbian
Work-based learning	In the College laboratories equipped with state-of-the-art equipment; In business systems whose main activities are relevant to the needs of this study programme.
Head of the study programme	Ljiljana Trumbulović, PhD

Programme objectives

The aim of this study programme is to provide students with knowledge and skills required for different jobs in mechanical engineering and similar industries and therefore improve their employability. It allows students to take an active part in designing their education through the selection of courses.

Programme outcomes

General outcomes:

- students develop logical thinking skills that will help them solve practical problems in real-world settings;
- students acquire both theoretical and practical knowledge on different methods and procedures that they can apply to practice;
- students can work successfully both individually and as team members.

Specific outcomes:

- students develop their understanding of manufacturing and thermal engineering;
- students are able to make connections between knowledge acquired in different fields in order to ensure a multidisciplinary approach to solving specific problems;
- students can successfully apply the acquired theoretical knowledge to production design, planning and management;
- the knowledge of foreign languages and information technology will help students improve the quality of their future work;
- students acquire the knowledge of international and national standards and regulations relating to production engineering;
- students acquire knowledge and develop their understanding of thermal technology;

- students can solve discipline-specific practical problems using knowledge acquired in different vocation-related subject areas, taking into account environmental protection and sustainable development;
- students can solve problems relating to designing, testing and maintenance of thermo-technical installations drawing on the acquired knowledge and gained experience, as well as foreign language proficiency and IT skills;
- students can understand professional literature, standards and other relevant information and use them when solving specific tasks in the field of thermal technology;
- students can apply occupational safety principles in order to reduce the risk of work-related injuries and diseases of workers;
- upon the completion of this study programme, students will have acquired the foundations for further education at specialist and higher-degree studies;
- upon the completion of this study programme students can qualify for the licence for responsible contracting engineers, granted by the Serbian Chamber of Engineers).

COURSE SPECIFICATIONS
Undergraduate Study Programme: MECHANICAL ENGINEERING

No.	Code	Course title	Semester	Course status	Active teaching classes			Other classes	ECTS
					Lectures	Practical classes	Other forms of instruction		
1	13111	Mathematics 1	1	C	2	2	0		6
2	13122	Physics	1	C	2	2	0		6
3	13123	Mechanics	1	C	2	2	0		6
4	13124	Technical Drawing and Descriptive Geometry	1	C	2	3	0		6
5	13125	Materials	1	C	2	2	0		6
6	13211	Quality Measurement and Control	2	C	2	2	0		6
7	13221	Mathematics 2	2	C	2	2	0		6
8	13222	Informatics Fundamentals	2	C	2	2	0		6
9	13223	Resistance of Materials	2	C	2	3	0		6
10	13224	**Elective Course 1**	2	E	2	0	0		6
	132241	English 1							
	132242	Russian 1							
II Year									
11	13311	Electrical and Electronic Engineering	3	C	2	2	0		6
12	13312	Application Software	3	C	2	2	0		6
13	13313	Computer Control	3	C	2	2	0		6
14	13314	Machine Elements	3	C	2	2	0		
15	13315	**Elective Course 2**	3	E	2	2	0		6
	133151	English 2							
	133152	Russian 2							
16	13411	Cutting Processes	4	C	2	2	0		6
17	13412	Deformation Processing	4	C	2	2	0		6
18	13413	Thermodynamics and Heat Devices	4	C	2	2	0		6
19	13414	Computer-Aided Design 1	4	C	2	2	0		6
20	13415	**Elective Course 3**	4	E	2	2	0		6
	134151	Tools and Equipment							
	134152	Pumps, Processors and Fans							
III Year									
21	13511	Machine Tools	5	C	2	2	0		5
22	13512	CNC System Programming 1	5	C	2	2	0		6

23	13513	Thermal Power Plants	5	C	2	2	0		6
24	13514	**Elective Course 4**	5	E	2	2	0		6
	135141	Mathematical Modelling							
	135142	Occupational Safety							
25	13515	**Elective Course 5**	5	E	2	2	0		6
	135151	Wood Processing Machines and Tools							
	135152	Gas and Gas Installations							
26	13611	Energy Efficiency	6	C	2	2	0		5
27	13612	Computer-Aided Design 2	6	C	3	3	0		6
28	13613	Heating and Air Conditioning	6	C	3	3	0		6
29	13614	**Elective Course 6**	6	E	2	2	0		5
	136141	Introduction to Object-Oriented Programming							
	136142	CNC System Programming 2							
30	13615	Professional Practice	6	C				6	2
31	13616	Final Thesis	6	C					6

Study Programme	**Mechanical Engineering**
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Field of study	Engineering and Technology
Mode of study	Full-time
Language of instruction	Serbian
Work-based learning	In the College laboratories with state-of-the-art equipment; In business systems whose main activities are relevant to the needs of this study programme
Head of the study programme	LjiljanaTrumbulović, PhD
Access to further study	Upon the completion of studies, students enroll in specialist and master's study programmes

Programme outcomes

General outcomes:

- students develop logical thinking skills and problem-solving skills enabling them to find optimal solutions for practical problems;
- students can apply the acquired theoretical knowledge to practice;
- students develop individual and teamwork skills.

Specific outcomes:

- students are familiar with and develop understanding of different fields of mechanical engineering and thermo-technics;
- students can combine several fields of study and apply a multidisciplinary approach to solving specific problems;
- students use the acquired knowledge to design, plan and implement manufacturing operations;
- students acquire a solid foundation for further professional development, keeping pace with innovations in the field of production engineering;
- foreign language fluency and computer literacy enhance students' career opportunities;
- students become familiar with international and national standards and regulations in the field of mechanical engineering, fire protection and occupational safety and health;
- students are able to solve practical problems in their field of work using the acquired knowledge and striving to ensure environmental protection and implementation of principles of sustainable development;
- students are able to solve problems relating to designing, testing and maintenance of thermo-technical installations using not only the acquired professional knowledge and experience, but also the knowledge of foreign languages and computer skills;

- students use professional literature, standards and other relevant information when solving problems relating to thermo-technics;
- students can successfully implement occupational safety principles in order to prevent workplace injuries and illnesses, and equipment damage incidents;
- students gain a solid foundation for continuing education at specialist or higher level studies.

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Application Software

Teacher: Milivojević S. Milovan

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Practical classes, colloquium, seminar paper.

Course aim:

Teaching students how to recognize standard IT models of real objects suitable for the efficient processing and analysis using spreadsheet recalculation programmes. Mastering modern software tools for project management. The application of data base theory, techno-economic optimization theory and linear programming to typical examples from practice. What If analysis.

Course outcomes:

Students will acquire the necessary level of theoretical knowledge and develop practical skills required to perform advanced functions relating to What-If-Analysis, pivot tables, scenarios, flat databases, techno-economic optimization, linear programming and project management on typical examples from practice, using the general purpose application software.

Syllabus:

Theoretical instruction:

General purpose apllication software. History of spreadsheets. Excel 2010. Interface. Fields of application. Additional features and applicability. Examples. Dynamic recalculation. Data types. Formatting. Relative, mixed and absolute addresses. Excel file structure. Worksheet operations. Control of interdependent cells. Basic functions: Sum, Average, IF, SumIf, CountIf. Addressing ranges and cells. Comments. Conditional formatting. Time functions. Text functions. Profesional diagrams. Selected examples. Advanced Excel functions: Subtotal, Vlookup, Match, Offset, Index... Data validation. Worksheet protection.

Data lists in Excel. Sequences. Mathematical bases. Sorting. Filtration. Authomatic filters. Advanced filtration. Subtotals. Selected examples. Pivot tables. Pivot charts. Consolidation. Regression analysis. Least squares method. Extrapolation.

Techno-economic optimization. Extreme values of functions. Limitations. Mathematical bases of linear programming. Goal function. What-If-Analysis. Goal seek. Scenario generation. Examples from practice. Optimization using software modules. Use of Solver.

Price calculation. Shelf-life control and stock management. Transportation problems. Procurement control and optimization from the aspect of the lowest price. The use of Solver for food processing optimization.

Use in management. Management of complex projects. Dynamic Gantt charts in project management. Resource engagement analysis. Project milestones. Cost analysis.

Comparative analysis of modern software packages in the field of project management: CA Super Project, MS Project Manager.

Practical instruction:

The practical instruction comprises practical exercises and tasks. Working with computers in college laboratories students perform the selected practical tasks grouped in thematic units. Two thirds of the time is devoted to these exercises, whereas another third is devoted to the preparation of examples from practice. The work is performed in groups of 3 students.

Literature:

1. C. Frye, Excel 2010, Korak po korak, Mikro knjiga, Beograd, 2011.
2. J.Walkenbach, Excel 2007 Biblija, Mikro knjiga, Beograd, 2007.
3. P. Blattner i dr, Vodič kroz Excel 2003, CET, Beograd, 2004.
4. S. Opricović, Optimizacija sistema, Građevinski fakultet, Beograd,, 1992.
5. A. Bateler, Access 2003 bez tajni, Kompjuter biblioteka, Čačak, 2004.
6. MicroSoft, Project Manager, Korak po korak, Mikro knjiga, Beograd, 2004.
7. C. Cartfield, Timothy Johnson, Microsoft Project 2010 Korak po korak, Mikro knjiga, Beograd, 2011.

Number of active teaching classes: 60	Lectures: **15x2=30**	Practical classes: **15x2=30**

Teaching methods: Classical methods (didactic: oral presentations accompanied by overhead projector presentations, exercises and practical work, demonstration of computer-based tasks using an overhead projector). Specific methods (Step by Step). Interaction forms: whole class work, teamwork, mentorship.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Lectures	Up to 5	Written exam	Up to 50
Practical classes	Up to 15		
Colloquium	Up to 15		
Seminar paper	Up to 15		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: CNC Programming I

Teacher: Slobodan M. Petrović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Providing students with knowledge about modern CNC machining and introducing them to main differences between designing CNC machining technology and designing traditional manufacturing technology regarding their applicability, productivity, economy and total processing efficiency.

Course outcomes: Students acquire knowledge about the structure, technical and technological capabilities of CNC systems, about designing CNC technology and programming CNC systems, and they become able to use the acquired knowledge in order to solve practical production-related problems.

Syllabus:

Theoretical instruction:

CNC machining systems, their emergence, development and importance for the automation of manufacturing techno-technological systems. Cartesian coordinate systems and characteristic points of the working environment of 2-axis CNC machines (lathes). Technologial preparation for programming. Software structure of 2-axis CNC machining systems (lathes). Motion types in CNC machines. Programming in polar coordinate system. Processing tools of numerically controlled lathes. Sub-programmes and cycles. Contouring. Automatic programming.

Practical instruction:

Preparation and adjustment of tools. Operating a CNC machine (lathe) in the manual mode. Technologial preparation for manual programming. Linear interpolation. Circular interpolation. Programming in polar coordinate systems. Tool compensation and correction. Processing using two or more tools. Processing using sub-programmes. Defining workpiece contours. Longitudinal and transversal grinding cycles. Threading and drilling cycles. Workpiece processing using two clamping devices. Defining geometric shapes using G-code.

Literature:

1. Žunjanin, R., Programiranje CNC sstems, Skripta, VTŠ, Novi beograd, 2006.
2. Stajčić, M., Numerički upravljane mašine alatke, Zavod za udžbenike i nastavna sredstva, 1984.
3. Bojanić, P., Puzović, R., Proizvodni sistemi APT-jezik, programiranje numerički upravljanih mašina alatki, II izdanje, Mašinski fakultet, Beograd, 2010.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Work with text, 4 Case studies, brochures, instructions and other demonstration materials, 5 Laboratory work

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	30
Practical classes	10	Oral exam	30
Colloquia	0		
Seminar papers	20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: CNC Programming II

Teacher: Slobodan M. Petrović

Course status: Elective

Number of ECTS: 5

Prerequisites: None

Course aim: Improving students' knowledge about modern CNC machining regarding its applicability, productivity, economy and total processing efficiency.

Course outcomes: Students acquire deeper knowledge about the structure, technical and technological capabilities of CNC systems, about designing CNC technology and programming CNC systems with three or more axes, and they become able to use the acquired knowledge in order to solve practical production-related problems.

Syllabus:

Theoretical instruction:

Coordinate systems and characteristic points in the working environment of CNC machines with three or more moving axes. Technologial preparation for programming. Software structure CNC machines with three or more moving axes. Motion types in CNC machines with three or more moving axes. Programming in polar coordinate system. Processing tools of numerically controlled grinders and mills. Sub-programmes and cycles. Workpiece contouring. Automatic computer-aided programming. Generating tool path and NC model porocessing programme. Methods of defining tool path for milling and drilling processes.

Practical instruction:

Preparation and adjustment of tools for CNC mills-drills and processing centres. Operating a CNC machine (mill-drill) in the manual mode. Technologial preparation for manual programming. Linear and circular interpolation. Programming in polar coordinate systems. Tool compensation and correction. Processing using two or more tools. Processing using sub-programmes. Drilling, unwinding and grinding cycles. Cutting circular holes and slots, as well as rectangular and circular pocketing. Defining workpiece contours. Producing complex workpieces. Automatic programming. Generating processing programmes.

Literature:

1. Žunjanin, R., Programiranje CNC sstems, Skripta, VTŠ, Novi beograd, 2006.
2. Bojanić, P., Puzović, R., Proizvodni sistemi APT-jezik, programiranje numerički upravljanih mašina alatki, II izdanje, Mašinski fakultet, Beograd, 2010.
3. Gradimir Čučković, SolidWorks i SolidCAM osnove, CET, Beograd, 2017.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Work with text, 4 Case studies, brochures, instructions and other demonstration materials, 5 Laboratory work

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	30
Practical classes	10	Oral exam	30
Colloquia	0		
Seminar papers	20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Computer Control

Teacher: Milovan S. Milivojević

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: The aim of the course is to teach students how to design process-control systems and to introduce them to the fundamentals of control so that they can solve practical problems in this field successfully, as well as to provide them with the skills required to work with industrial computers, which requires a good knowledge of operating modes, functions, programming, selection and applications in machine and process control.

Course outcomes: Upon the completion of this course, students will be able to design control systems based on PLC and CNC machines.

Syllabus:

Theoretical instruction:

Introduction - process control, aim, applications. Types of process control systems. Continuous systems (system recognition). Digital systems – numerical systems, codes, switching algebra, minimization of logic functions. Implementation of control systems. Designing combinational and sequential control systems. Types of industrial PCs and their role in the process of control. Working principles and major functional characteristics. Hardware components - central processing unit, memory, input/output systems. Data acquisition systems, A/D and D/A conversion. Programming industrial PCs, programming languages. PLC – properties, working principle, hardware. PLC programming – relay diagram language, basic functions. CNC control software - structure, types, measuring, propulsion and control systems, programming. Control of industrial robots and manipulators – structure, geometry, propulsion systems, closing devices, control systems, programming, programme languages. Safety and protection measures in computer control of machines and processes.

Practical instruction:

Numerical systems, operations with logic functions. Minimization of logic functions. Programming combinational and sequential control systems. Basic components of control systems, simbols, functions and applications. Implementation of pneumatic, relay and electronic control systems. Computer simulation of pneumatic and hydraulic systems. Examples of programming PLC and CNC machines. PLC - components, connection, programming modes, monitoring. Implementation of the PLC-based control. Industrial PCs – components, connection, programming modes. Implementation of control using industrial PCs. Positioning using optical linear encoders and PLC-based control. Programming and simulation of the CNC-based control – SinuTrain. Presentation of a designed robot. Consultations and instructions for individually performed assignments. Review of individually performed assignments.

Literature:

1. Zarić S., Automatizacija proizvodnje, Mašinski fakultet, Beograd, 1995.
2. Jones C.T., Bryan L.A., Programmable Controllers-Concepts and Applications, IPC, Atlanta, 1983.
3. Kovačević R., Stanić J., Računari, NC, CNC, DNC, Naučna knjiga, Beograd, 1987.
4. Potkonjak V., Robotika, Naučna knjiga, Beograd, 1989.
5. Drndarević D., Upravljanje procesima - priručnik, BTC, Užice, 2003.
6. S. Joshi, Jeffrey Smith. Computer control of flexible manufacturing systems, Springer Science & Business Media
7. Soloman S., Sensors Handbook, McGraw-Hill, New York, 2010.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Case studies, brochures, instructions and other demonstration materials, 4 Laboratory work			
Knowledge evaluation (maximum number of points: 100)			
Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	30
Practical classes	20	Oral exam	-
Colloquia	10		
Seminar papers	30		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – First Degree Studies

Course title: Computer-Aided Design I

Teacher: Damnjan D. Radosavljević

Course status: Compulsory

Number of ECTS: 6

Prerequisites: In compliance with the Law on Higher Education and the Statute of the college

Course aim: Providing students with the skills required for drafting technical documents for specific mechanical parts using the appropriate software, as well as introducing them to software tools for easy drawing of 2D and 3D figures. Revision and practical use of the already acquired knowledge in Industrial drawing.

Course outcomes: Working on their own, students use computers to create technical documentation for machine parts, assemblies and sub-assemblies.

Syllabus:

Theoretical + practical instruction:

Introduction to Auto CAD editing. Defining layer, dimension style and text. Arrays: metrical and polar, with simple examples for practising. Drawing complex 2D forms. 2D and 3D illustration of the simplest stereometric shapes. Drawings for I and II technical assignment.

Literature:

1. Radosavljević, D., Sokić, M., Praktikum za vežbe iz tehničkog crtanja sa teorijskim osnovama Auto CAD 2D, COBISS – SR – ID 100604172, ISBN 86-7746-056-X, Niš, Sven, 2005.
2. Radosavljević, D., Tehničko crtanje Auto CAD 3D Modeling, Technical College Uroševac, Sven, Niš, 2005.
3. Sokić, M., Radosavljević, D., Tehničko ctranje i kompjutersko projektovanje CAD – 3D, COBISS-RS-IDI23867148, ISBN 86-7746-063-2, Sven, Niš, 2005.
4. Dihovični Đ, Kompjutersko projektovanje 1, Beograd, Technical College, 2007.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods: Verbal: lectures, interactive methods. Visual presentations. Practical computer-based activities.

Knowledge evaluation (maximum number of points 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Class attendance	0-10	Written exam	30
Homework	0-30	Oral exam	30
Colloquia	part of exam	computer-based exam	

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – First Degree Studies

Course title: Computer-Aided Design II

Teacher: Slobodan M. Petrović and Damnjan D. Radosavljević

Course status: Compulsory

Number of ECTS: 6

Prerequisites: none

Course aim: Students master the technique of 3D presentation of objects, i.e. of specific machine parts, and learn how to assemble the existing parts.

Course outcomes: Creating a 3D presentation of machine parts, sub-assemblies and assemblies. Fitting the existing units together into sub-assemblies and assemblies.

Syllabus:

Theoretical + practical instruction:

Introduction to SolidWORKS user interface. Setting user units. Presentation of simple planes, axes, points and Cartesian coordinate systems. Drawing in the appropriate plane, as well as using the main menu for drawing elementary 2D contours. Modelling machine parts. Detailed analysis of Extrude and Revolve commands. Explanation of Edit and Edit Feature options. Explaining parent-child relationship between specific parts. Modelling more complex geometric shapes using Sweep and Blend options. Fitting the existing units together into assemblies. Drawing parts and assemblies.

Exercises: drawing pulleys and making assemblies (gears, shafts, pistons), drawing some machine parts, drawing tools (assemblies).

Literature:

1. Dihovični Đ, Živojinović D., Kompjutersko projektovanje II, VTŠ, Novi Beograd, 2008.
2. Sham Tickoo, SOLIDWORKS 2015 za mašinske inženjere, Mikro knjiga, Beograd, 2015.
3. Gradimir Čučković, SolidWorks i SolidCAM osnoce, CET, Beograd, 2017.
4. SolidWorks tutorials – licensed version
   a http://www.solfins.com/strana.php?seo_link=referenc-lista&start=90

Number of active teaching classes: 90				Other classes:
Lectures: 3x15=45	Practical classes: 3x15=45	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Work with text, 4 Case studies, brochures, instructions and other demonstration materials, 5 Laboratory work.

Knowledge evaluation (maximum number of points 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	30
Practical classes	10	Oral exam	0
Colloquia	30	computer-based exam	
Seminar paper	20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Cutting processes

Teacher: Slobodan M. Petrović

Course status: Elective

Number of ECTS: 6

Prerequisites: None

Course aim: Studying about cutting processes and general issues relating to them.

Course outcomes: Students can independently design optimal cutting technology.

Syllabus:

Theoretical instruction:

Chip formation mechanisms. Geometry of cutting wedge. Cutting process mechanics. Tribology and steadiness of tools. Processed surface quality. Economics of metal cutting operations. Techno-economic optimisation of cutting processes. Cutting procedure – operations and tools, speed and cutting resistance. Selection of optimal cutting methods – scraping, grating, drilling, milling, sawing, grinding, pulling, smoothing, superfinish processing and polishing, producing coils, gears, etc.

Practical instruction:

Types, forms and geometry of cutting tools, shape of chips. Resistance measurement and cutting temperature. Measuring roughness of processed surfaces and tool wear. Processing methods: scraping, grating, drilling, grinding, milling, sawing, pulling, producing coils, gears, etc. Designing optimal procedures for the purpose of completing a task, including the claculation of optimal cutting settings uing conventional, NC and CNC machines.

Literature:

1. Milutinović, I., Mašinska obrada I – Uvod u teoriju rezanja, Prometej, Užice, 1994.
2. Milutinović, I., Mašinska obrada II – Postupci obrade rezanjem, Prometej, Užice, 1995.
3. Kalajdžić, M., Tehnologija mašinogradnje, XII izdanje, Mašinski fakultet, Beograd, 2014.
4. Kalajdžić, M., et al., Tehnologija obrade rezanjem – priručnik, Mašinski fakultet, Beograd, 2012.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Laboratory work , 3 Case studies, brochures, instructions, etc.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	20
Practical classes	10	Oral exam	30
Colloquia	20		
Seminar papers	10		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Deformation Processing

Teacher: Aćimović M. Dragomir

Course status: Compulsory

Number of ECTS: 6

Prerequisites: none

Course aim: Students acquire knowledge and develop competencies necessary for designing metal deformation processing technology.

Course outcomes: Students are competent enough to design technology and deformation processing regimes in machining processes on their own.

Syllabus:

Theoretical instruction:

Fundamental principles, focus and scope of study and significance of deformation processing. Development and theoretical grounds of deformation processing: nature of plastic deformation. Deformation, nominal and True strain. Crystal composition of metals. Hardening curves and their analytical functions. Deformation processing regimes: cold working, hot working and high-velocity deformation. Recovery and recrystallization. Deformation velocity. Specific deformation resistance, deformation effect and deformation force. Plastic flow hypotheses. Contact friction. Deformation processing procedures and regimes: cutting with scissors, cutting through metals, drilling using drill-presses. Strain ratio, calculation of force and deformation effect of cross cutting and cutting through. Methods of rational use of materials. Bending deformation. Bending moment. Elastic-plastic bending and pure plastic bending. Common types of bending and calculation of deformation effect and bending force. Elastic straightening of bended parts. Deformation by drawing. Dimensioning different blank shapes. Strain-displacement relationship. Designing deep-drawing technology for different shapes, with and without changing wall thickness. Analysis of deep-drawing forces and deformation effects. Extrusion processes and metal processing by extrusion: extrusion in one direction, extrusion in both directions, free pressing strike-throughs. Calculation of force, deformation effect and technology design. Forging using molds. Design parametres of forgings, their elements and tool elements. Forging using forging hammers, friction screw presses and hydraulic presses. Classification of forged engravings and forging process design. Forging stages per group. Blanking and piercing of forgings. Other plastic deformation processes: plastic mass, unconventional processes, powder pressing in powder metallurgy, etc. Safety and protection measures during deformation processing, identification of risks and risk reduction/elimination measures.

Practical instruction:

Students are divided into groups for laboratory exercises which areorganised in production plants or laboratories in relevant companies. Students are introduced to different types of deformation processing machines and tools. Project (seminar paper preparation) consists of two tasks: designing a technological process for specific examples of plastic deformation products.

Literature:

1. Panić, S., Obrada deformisanjem – pisana predavanja, Visoka poslovno-tehnička škola Užice, 2010.
2. Kalajdžić, M., Tehnologija mašinogradnje, Mašinski fakultet, Beograd, 2007.
3. Musafija, B., Obrada metala plastičnom deformacijom, Svetlost, Sarajevo, 1988.
4. Panić, S., et al. Bezbednost i zdravlje na radu – knjiga 2 – modul 2, VPTŠ Užice, 2011.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Writing and drawing on the board, presentations using overhead projectors and computers with proper application software. Practical instruction is organized in laboratories and production plants.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**

Activity during lectures	10	Written exam	50
Practical classes	10	Oral exam	
Colloquia	-		
Seminar papers	30		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Electrical and Electronic Engineering

Teacher: Vidoje N. Milovanović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Introducing students to the fundamental principles of electrical and electronic engineering; training them to use scientific and professional achievements in solving problems of environmental protection and improvement.

Course outcomes: Students can apply the acquired knowledge of electrical and electronic engineering and develop the system of ecological behaviour and positive attitudes to the nature, which will result in environmental protection and improvement. Through the acquisition of knowledge and skills, students gain professional competence in environmental protection.

Syllabus:

Theoretical instruction:

Electrical engineering: Electrostatics. Constant direct currents. Electromagnetism. Alternating currents. Electric machines and electrical measurements. Occupational safety and health. Electrical hazards and respective protective measures.

Electronic engineering: Semiconductors. Diodes. Transistors. Thyristors. Amplifiers. Integrated circuits. Non-ionizing electromagnetic radiation.

Practical instruction:

Laboratory exercises. Measuring resistance and power of receivers, using an oscilloscope to measure frequency, using an oscilloscope for time interval measurement, using an oscilloscope for voltage measurement, magnetic field measurement; diode characteristics, transistor characteristics, rectifiers, transistors as switches; measuring the radiation of mobile phones.

Literature:

1. Elektrotehnika sa elektronikom, Vidoje Milovanović, Užice, 2005.
2. Elektrotehnika sa elektronimkom zbirka zadataka, Vidoje Milovanović, Užice, 2006.
3. Elektrotehnika, Vidoje Milovanović, Užice, 2009.
4. Elektronika, Vidoje Milovanović, Užice, 2009.
5. Grupa autora: Bezbednost i zdravlje na radu - knjiga 1-modul 1-VPTŠ Užice, 2011.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods::

Dialogue, monologue, practical work demonstration, work with texts, studying specialized literature.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	0
Practical classes	20	Oral exam	40
Colloquia	20		
Seminar papers	10		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Energy Efficiency

Teacher: Damnjan D. Radosavljević and Dragomir M. Aćimović

Course status: Compulsory

Number of ECTS: 5

Prerequisites: None

Course aim: **S**tudents learn about the basic principles, thermodynamic conditions and limitations of the processes of energy generation, transmission and transformation, as well as about environmental benefits of efficient energy use. They learn about the possibilities of improving energy processes, technological operations, thermo-physical properties of residential and business facilities, by increasing their energy efficiency.

Course outcomes: Students will have acquired knowledge on the necessity and importance of efficient energy use, principles and possibilities of increasing process quality and saving energy by improving the energy efficiency of industrial operations, processes and devices, as well as by improving thermo-physical properties and energy efficiency of residential and business facilities. Students will be able to understand and analyse the observed energy processes and apply the acquired knowledge independently and in a creative manner in their scientific research.

Syllabus:

Theoretical instruction:

Basic definitions and the possibility of calculating the efficiency of processes and devices. Thermomechanical equations of state, and energy equations. The principles of material and energy balance of thermomechanical systems. The energy and exergy degerees of usefulness of processes and devices. The efficiency of heating equipment. The efficiency and environmental impact of power plants. The efficiency of cooling processes and equipment. Modern technologies for increasing energy efficiency. Energy efficiency of buildings and facilities. The possibilities of saving heating and air-conditioning energy, new technology, using energy from renewable resources, green buildings. Introducing students to basic principles of cost effectiveness analysis and defining environmental benefits of energy efficient processes. The situation and perspectives in the country and abroad.

Practical instruction:

The processes of calculating the thermodynamic degree of usefulness and efficiency of basic heating processes. The analysis of the potential increase in energy efficiency using specific thermo-energetic and thermo-technical processes and plants. Heat loss analysis methods and energy saving measures in the construction of buildings. Studying the energy efficiency issues of high importance for the scientific-research work of each student.

Literature:

1. LDK Conutants SA, Agencija za energetsku efikasnost Republike Srbije, Materijal za obuku za gazdovanje energijom u opštinama, Beograd 2005.
2. Karamarković V., Ramić, B., Gordić, D., et al. Uputstvo za izradu energetskih bilansa u opštinama, http://www.mfkg.kg.ac.yu/component/option,com_docman/task,cat_view/gid,125/Itemid,27/
3. Capehart V., W. Turner, W. Kennedy, Guide to Energy Management, Fourth ed., The Fairmont Press, 2003.
4. Jasmina Radosavljević, Tomislav Pavlović, Miroslav Lambić, Solarna energetika i održivi razvoj, Građevinska knjiga, Beograd, 2004.
5. Boris Labudović, Frano Barbir, Julije Domac, et.al., Obnovljivi izvori energije, energetika marketing, Zagreb, 2002.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Theoretical and practical instruction, audio-visual exercises, 2 colloquia, written and oral exam. Analytical methods of assessing the efficiency of heating processes and introducing students to the existing software packages. Visiting the laboratory of the Materials testing institute of Serbia and practical

introduction to the processes and methodology of assessing energy efficiency in the construction of buildings.			
Knowledge evaluation (maximum number of points: 100)			
Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	20
Practical classes	30	Oral exam	20
Colloquia (2x10)	20		
Seminar papers	-		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: English 1

Teacher: Marinković M. Ivana

Course status: Elective

Number of ECTS: 6

Prerequisites: None

Course aim: Acquiring the necessary knowledge of English for General Purposes, as well as of English for Specific Purposes; further development of language skills; reading comprehension and conversation about general and discipline-related topics; providing students with skills required for both oral and written business communication in English.

Course outcomes: Successful use of acquired knowledge in specific situations. Providing continuous foreign language education upon high school completion. Achieving proficiency in English for Specific Purposes.

Syllabus:

Theoretical instruction:

Nouns (plural of nouns). Pronouns (personal, possessive, relative, reflexive). Relative clauses. Articles (types and use). Adjectives and adverbs (comparison). Verbs (tenses).

English for Specific Purposes – introduction to specialized vocabulary using specialized texts.

Business English – business correspondence rules and formal expressions.

Practical instruction:

Grammar exercises, listening and speaking exercises aimed at the integration of lexical and grammatical knowledge; oral and written translation; writing business letters, CVs, etc.

1. Lansford, L. & Astley, P., Engineering 1,2013, Oxford, Oxford University Press
2. Naunton, J., 2005, ProFile 2, Oxford, Oxford University Press
3. Murphy, R., 1990, English Grammar in Use, Cambridge University Press
4. Thompson A.J., Martinet, A.V., 1994, A Practical English Grammar, Oxford, OUP
5. Dictionary of Mechanical Engineering, 2013, OUP

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Monologue, dialogue, combined teaching methods, work with text

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	15
Practical classes	10	Oral exam	15
Colloquia	50		
Seminar papers			

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: English 2

Teacher: Ivana M. Marinković

Course status: Elective

Number of ECTS: 6

Prerequisites: Passed examination in English 1.

Course aim:

Acquiring the necessary knowledge of English for General Purposes, as well as of English for Special Purposes; further development of four language skills: reading comprehension skills, listening, speaking and writing skills. Providing students with the skills required for both oral and written communication in English on management-related topics.

Course outcomes:

Students can use English for Specific Purposes successfully.

Syllabus:

Theoretical instruction:

Verbs (auxiliary and modal). Conditional sentences. Numbers. Passive. Reported speech (sequence of tenses). Future forms.

English for Specific Purposes – introducing students to discipline-related vocabulary through work with speacialised texts.

Business English –business correspondence rules and formal expressions.

Practical instruction:

Grammar exercises, listening and speaking exercises aimed at the integration of lexical and grammatical knowledge; oral and written translation; successful communication in business situations using English for mechanical engineering.

1. Lansford, L. & Astley, P., Engineering 1,2013, Oxford, Oxford University Press
2. Naunton, J., 2005, ProFile 2, Oxford, Oxford University Press
3. Murphy, R., 1990, English Grammar in Use, Cambridge University Press
4. Thompson A.J., Martinet, A.V., 1994, A Practical English Grammar, Oxford, OUP
5. Dictionary of Mechanical Engineering, 2013, OUP

Number of active teaching classes: 60				Other classes:
Lectures: 30	Practical classes: 30	Other forms of instruction:	Research study:	

Teaching methods: Monologue, dialogue, combined teaching method, work with text.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	15
Practical classes	10	Oral exam	15
Colloquia	40		
Seminar papers	10		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Gas and Gas Installations

Teacher: Aćimović M. Dragomir

Course status: Elective

Number of ECTS: 6

Prerequisites: Completed project and homework assignments and passed colloquium

Course aim: Students acquire fundamental knowledge about gas and gas installations, which are increasingly used in households, processing industry and thermo-technics. The programme is delivered through lectures and practical classes, designed so as to help students understand different ways of production, transport, storage, and exploitation of gas.

Course outcomes: Upon the completion of this course, students will be able to perform certain calculations on their own, choose gas metering and regulation stations and monitor the installation of gas pipelines and equipment.

Syllabus:

Theoretical instruction:

Introductory lecture about natural gas and natural gas liquid (NGL). Real vs. Ideal gas equation. Caloriffic value of gas. Chemical and physical properties of gas. Distribution. High pressure gas piplines. Gas metering and regulation stations. Gas fittings. Gas consumption. Gas flow measement. Differential pressure flow meters. Gas boilers.

Practical instruction:

It implies using theoretical knowledge to solve specific problems relating to dimensioning, selection of gas metering and regulation stations, hzdraulic calculations, dimensioning low-pressure gas pipelines. Special attention is paid to the calculations regarding complex pipelines, and students are advised about relevant literature. Each student performs a project assignment on a topic relating to internal gas installations.

Literature:

1. All JUS and DIN standards in the field of mechanical engineering.
2. M. Sokić, Projektovanje kućnih gasnih podstanica i gasnih instalacija, Zbornik radova urađen u elektronskom obliku na CD-u u izdanju VPTŠ Užuce, ISBN 978-86-83573-22-6, oktobar, 2011.
3. B. Škrbić, Tehnologija tehnologije i primene gasa, Novi Sad, 2002.
4. Law on Natural Gas Transport, Distribution and Use
5. Natural gas and propane-butane regulations.
6. Šumić, Pavlović, Efikasnost merenja i obračuna potrošnje plina, Energetika – marketing, Zagreb, 2000.
7. Buljak, V., Tečni naftni gas, Udruženje za gas, Beograd, 2004.
8. Sadžković, M., Antonić, M., Glušica, D., Bogner, B., Priručnik za gasnu tehniku, Eta, Beograd, 2013.
9. Bogner, M., Isailović, M., Prirodni gas, Eta, Beograd, 2008.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Work with text, 4 Case studies, brochures, instructions and other demonstration materials, 5 Laboratory work

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	30
Practical classes	20	Oral exam	-
Colloquia	30		
Seminar papers	20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Heating and Air Conditioning

Teacher: Aćimović M. Dragomir

Course status: Compulsory

Number of ECTS: 6

Prerequisites: none

Course aim: Introducing students to the theories of heating, air conditioning and ventilation in facilities.

Course outcomes: Upon the completion of this course, students will have acquired knowledge on the basics of the design, installation and maintenance of heating, air conditioning and ventilation in facilities.

Syllabus:

Theoretical instruction:

The history of heating systems. Heating, air conditioning and ventilation. Differences, basic characteristics and the expected development in the future. Environmental thermal parametres. People and the environment. Comfort conditions. Body temperature regulation. The zone of comfort. The characteristics of outdoor temperature and its infulence on indoor temperature characteristics. Outdoor temperature and its changes during a daily and yearly basis. Outdoor design temperature and how to calculate it. Outdoor design parametres for ventilation and air conditioning. Heat transfer through walls, windows and roofs. Calculating the temperature of a wall. Heat transfer coefficients. Condensation occurence. Wall insulation: external or internal. Estimating the total amount of heating required. Heat loss through windows and walls. Heat loss due to air infiltration.Calculating the needed central heating system capacity. Heating appliances. Types and manners of heat generation: radiators, convectors, pipes, panels. Changes of the amount of generated heat due to the temperature of the thermal fluid. Water and steam as heat carriers. Heating appliances and fittings. Dimensioning. Heat sources in central heating systems and their characteristics. Natural ventilation. Safety devices and necessary fittings. The effect of wind on air infiltration in buildings. Pipe sizing in gravity hot-water heating and heat pump water heating. Single pipe central heating system. Low pressure central heating. Upper and lower distribution piping. Laying heating pipework at different heights. Pipework calculations. Pipework insulation. Optimal insulation width. Forced ventilation. Calculating air volume. Ventilation chamber and its elements. Automatic control of heating systems. Remote heating control. Characteristics of remote heating. Heat source, pipework. Connection substations. Substations scheme. Solar energy. Characteristics of solar radiation. Solar energy receivers. Solar heating systems. General ventilation principles. Ventilation for heating and cooling purposes. Hood design. High-speed exhaust systems with low flow rates. Designing process. Fresh and recirculation air. Construction requirements for local exhaust systems. Testing ventilation systems. Fans. Air purifiers.

Practical instruction:

Auditory exercises and independent work are planned. Auditory exercises are compulsory and done in groups of three students. Independent work is done in groups of 15 students. One project assignment is performed. Visits to heating plants and specific facilities (companies, etc.) are also planned.

Literature:

1. Todorović B., Projektovanje postrojenja za centralno grejanje, Mašinski fakultet, Beograd, 2000.
2. Todorović, B., Klimatizacija, SMEITS; Beograd, 2005.
3. Reknagel, Šprenger, Šramek, Čeperković, Grejanje i klimatizacija, Interklima, V. Banja, 2002.

Number of active teaching classes: 90				Other classes:
Lectures: 3*15=45	Practical classes: 3*15=45	Other forms of instruction:	Research study:	

Teaching methods: Theoretical and practical instruction, auditory exercises, project assignments, seminar papers

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**

Activity during lectures	10	Written exam	30
Practical classes		Oral exam	20
Colloquia			
Seminar papers (2x20)	40		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Informatics Fundamentals

Teacher: Ivković V. Nebojša

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim:

- Students will acquire advanced knowledge and will be trained to use:
- MS Word
- Adobe Photoshop
- MS Excel
- MS Power Point

Course outcomes:

- Advanced text processing techniques:
  - Using sections (creating sections, working with sections, section properties)
  - Using section breaks in documents, together with headers and footers
  - Changing the orientation of certain pages of a document
  - Using different number of columns on a single page and in a document as a whole
  - Designing styles (adding and removing text styles, saving and using them…)
  - Multilevel lists
  - Creating content (automatically and manually, adjusting text using TAB key)
  - Indexing
  - Bookmarks
  - Hyperlinks
  - Electronic forms
  - Circular letters
  - Preparing documents for double-sided printed (margins, page numbers)…
- Digital image processing using Adobe Photoshop, for documents prepared using MS Word.
- Spreadsheet design and different ways of automatic data processing applied to complex practical examples using nested functions in MS Excel programme. Advanced forms of graphic illustration of data processed using MS Excel. Using macros to create reports based on the processed data, imported from another information system.
- Creating advanced presentations in MS PowerPoint by inserting different forms of animations on slides.

Syllabus:

Theoretical instruction:	**Practical instruction:**
1. MS Word	1. MS Word
2. Adobe Photoshop	2. Adobe Photoshop
3. MS Excel	3. MS Excel
4. MS Power Point	4. MS Power Point

Literature:

1. Alati grafičkog dizajna, Damnjan Radosavljević, Visoka poslovno-tehnička škola, Užice, 2014.
2. Excel 2007 Biblija, John Walkenbach, Mikro knjiga
3. Word 2016, Korak po korak, Joan Lambert, CET
4. PowerPoint 2010, Zvonko Aleksić, Kompjuter biblioteka

Number of active teaching classes: 60				Other classes:
Lectures: 30	Practical classes: 30	Other forms of instruction:	Research study:	

Teaching methods::

During lectures, the theoretical part of subject matter is illustrated by examples from practice. In the computer laboratory, students perform tasks relating to the theoretical instruction.			
Knowledge evaluation (maximum number of points: 100)			
Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Lecture attendance	10	Written exam	45
Attendance at practical classes	25	Oral exam	
Seminar paper	20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Introduction to Object-Oriented Programming

Teacher: Milovan S. Milivojević

Course status: Elective

Number of ECTS: 5

Prerequisites: Exercises, colloquium, seminar paper.

Course aim: Introducing students to the object-oriented thinking. Developing models of objects, attributes, methods, events. Mastering the key algorithmic structures, programme settings and object-oriented techniques. Laying the foundation of full-scale object-oriented programming.

Course outcomes: Students will master the basic concepts and techniques in the field of object-oriented applications and programming. Laying the foundation of a full-scale object-oriented programming.

Syllabus:

Theoretical instruction: Introduction to object-oriented concepts. Object-oriented programming. Objects. Attributes. Methods. Incomplete object models. MS Office applications – Host Applications. Basic VBA syntax.

VBA editor. Working with variables and constants. Types of variables. Scope and lifetime of constants and variables.

Creating VBA objects. Characteristics. Methods. Collections of VBA objects. Using and creating functions. Data conversion functions. String manipulation. VBA mathematical functions. Date and time functions.

Algorithms and structures. Using sequences. Declaration. Multi-dimensional sequences. Dynamic sequences. Creating procedures. Events. Using message boxes. Data entry boxes. Using loops to repeat actions. For…Next loops. Do loops. While…Wend loops. Nested loops. Decision making in a code. If…Then…Else. Multiple branching. Select case. Object models of application programmes. User forms. Designing. Control objects. Key properties. Dialogue boxes and procedures. User's choice. Examples. Complex dialogue boxes and update based on selection. Using events to control forms. Writing module codes and code debugging.

Creating procedures with good characteristics. Principles of defensive programming. Examples and solutions. Class. Encapsulation. Inheritance. Polymorphism. Composition. Thinking in object-oriented language. Class diagrams. Aggregation. Association. Avoidance of dependency. Cardinality.

Practical instruction:

Practical instruction is carried out in the form of computer-based assignments and seminar papers performed in college laboratories. Preparation of seminar papers is teamwork, done in groups of three students.

Literature:

1. M. Weisfeld, Objektno orjentisani način mišljenja, CET, Belgrade, 2003.
2. Guy Hart-Davis, VBA6 detaljan izvornik, Kompjuter biblioteka, Čačak, 2002.
3. P.McFedries, Vodič kroz VBA, Kompjuter biblioteka & QUE, Čačak, 2005.
4. S. Hansen, Excel 2003 programiranje u VBA, Kompjuter biblioteka & SYBEX, Čačak, 2005.
5. M. Cantu, Delphi 7, Kompjuter biblioteka & SYBEX, Čačak, 2003.
6. Uvod u VBA multimedijalni kurs, Anima, Belgrade, 2011.
7. FUNDAMENTALS OF COMPUTER PROGRAMMING WITH C#, The Bulgarian C# Programming Book, © Svetlin Nakov & Co., 2013.

Number of active teaching classes: 60				Other classes:
Lectures: 15*2=30	Practical exercises: 15*2=30	Other forms of instruction:	Research study:	

Teaching methods: Verbal: lectures, interactive teaching.

Visual: demonstration, illustration and presentation. Practical: laboratory, experimental and computer-based activities.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**

Activity during lectures	0-5	Written exam	25
Practical classes	0-20		
Colloquium	0-20		
Seminar paper	0-30		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Machine Elements

Teacher: Slobodan M. Petrović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Introducing students to the design and calculation of standard elements, sub-assemblies and assemblies.

Course outcomes: Students will be able to design standard elements and assemblies on their own.

Syllabus:

Theoretical instruction:

Preliminary design, synthesis of creative design, preliminary design and final design; development and creation of prototype and its testing. Design analysis. Safety factors, reliability and cost. Production processes and design. Primary processes (casting, sand casting, mold casting, continuous casting, plastic molding and ceramics casting, centrifugal casting, powder metallurgy, forging, forging in molds, etc.). Processes. Welding and soldering. Engineering drawings and dimensions. Definition of basic tolerated dimensions and defining the state of processed surfaces. Clamped and pressed assemblies. Strain concentrtion.

Geometric dimensioning of cyllindric gears with straight and slanted teeth, worm gears and cone-shaped gears with straight teeth. Stress caused by all types of gears and transmitted to shafts. Selection of main gear measures (width, height, leaning angle of a gear tooth, gear motions, transmission ratio).

Computer-aided shaft design in a space using the calculated dimensions.

Computer-aided design of the entire shaft bearer, containing all the necessary elements.

Modelling gears, sprokets, pulleys, chains and belts. Preparation of complete engineering drawings. Design and calculation of transmission belts, pulleys and toothed belts.

Practical instruction:

Design and calculation of cyllindric gears with straight and slanted teeth, and worm gears. Sliding-contact bearers and roller bearers. Types of bearers. Roller bearer dimensions and designation. Installation of bearers. Selection and service life calculation for bearers. Dynamics and static load capacity of bearers. Designing a prototype of an assembly and testing its usability on the market.

Literature:

1. Miltenović Vojislav, Mašinski elementi, 6. Izdanje, Mašinski fakultet, Niš, 2006.
2. Miltenović Vojislav, Mašinski elementi, tablice i dijagrami, 6. Izdanje, Mašinski fakultet, Niš, 2006

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Work with text, 4 Case studies, brochures, instructions and other demonstration materials

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	5	Written exam	30
Practical classes	5	Oral exam	0
Colloquia	30		
Seminar papers	30		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Machine Tools

Teacher: Slobodan M. Petrović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Providing students with knowledge about processing systems – machine tools, for the purpose of designing and implementing technologies relating to them.

Course outcomes: Students are familiar with technical possibilities and functioning of processing systems/machine tools, and can design and implement technologies relating to them on their own.

Syllabus:

Theoretical instruction:

Defining system and processing system. The history of the development of machine tools and technologies. Functional and disturbance observing sybsystems of a processing system as necessary elements for machine tool designing. Basic concepts and basic kinematic structures of machine tools. Classification of machine tools. Forging machines: free-fall hammers, air compressor hammers, hydraulic hammers and hydraulic-air compression hammers, hammers with shock isolation. Pressing machines – presses. Deformation forces and deformation process of presses. Mechanical presses. Hydraulic presses. Special deformation processing machines. Pressure casting machines and molding machines for plastics. Cutting machine tools. Classification of cutting machine tools. Primary and auxiliary motions of cutting machine tools. Machine tool pressure transducers: transducers for gradual changes of the number of cycles, transducers for continous changes of the number of cycles, and combined transducers. Electro-motor drive for machine tools. Asynchronous electro motors. Direct current motors. Servo motors. Characteristics of main types of cutting machine tools: lathes, grinders, drills, milling machines, and grating and pulling machines. Special purpose cutting machine tools: grinding, milling, peeling and smoothening. Safety and protection measures while operating different machine tools. Flexible processing and technological systems. Cost-effectiveness, productivity and pofitability of machine tools.

Practical instruction:

Students perform one laboratory activity and prepare a seminar paper. The laboratory activity is performed in a plant or laboratory. Students analyse machine kinematics and their driving power. During the semester, students are required to prepare one project/seminar paper in consultation with the professor.

Literature:

1. Slavko Zrnić, Mašine alatke 1, Mašinski fakultet, Banja Luka, 2005.
2. Borojev, Lj., Zeljković, M., Mašine alatke – prenosna struktura mašina alatki – mehanički prenosnici, Fakultet tehničkih nauka, Novi Sad, 2002.
3. Sreten Urošević, Proizvodno mašinstvo II deo, proizvodne mašine i numeričko upravljanje mašinama, Naučna knjiga, Beograd, 1988.
4. Kršljak Bogoljub, Brujić Đurađ, Proizvodne mašine, Novi Beograd, Politehnička akademija-VTŠ, 1999.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Preparation of seminar papers and discussion about it, 4 Case studies, brochures, instructions and other demonstration materials, 5 Practical assignment

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	50

Practical classes	10	Oral exam	
Colloquia	0		
Seminar papers	20		

Study programme: TECHNOLOGICAL ENGINEERING

Type and Level of Studies: UNDERGRADUATE VOCATIONAL STUDIES

Course code and title: MATERIALS

Teacher (Surname, middle initial, name): Trumbulović-Bujić Ljiljana

Course status: Compulsory

Number of ECTS credits: 6

Prerequisites: completed and defended laboratory exercises and a seminar paper

Course aims: The main goal is to introduce students to the structure and types of the most frequently used technical materials, both metal and non-metallic. In addition to traditional materials and technologies, students will learn about new materials and technologies whose advantages are significant in certain fields of application.

Learning outcomes: On the basis of the acquired knowledge, students should be able to select, design or determine the field and domain of the application of certain materials.

Syllabus

Theoretical instruction:

Materials science , materials technology and their interrelations. Atomic and electronic structure. Crystal structure. Properties of materials (chemical, metallographic, mechanical and technological). Iron metallurgy (raw iron, cast iron, steel – carbon, structural and alloy). Steel, properties and types. Special steel. Thermal treatment of steel and cast iron. Thermo-chemical treatment of steel and cast iron. Ferrous metallurgy. Polymer materials (thermo-plastic, thermo-reactive, elastomeric materials). Ceramic materials (traditional and advanced). Glass. Composite materials (particulate-reinforced, fiber-reinforced and laminate materials). Biomaterials. Electronic materials.

Practical teaching: Testing mechanical, metallographic and technological properties of materials. Impact testing. Tension testing. Compression testing. Hardness testing. Determination of dynamic strength. Metallographic testing. Technology testing. Thermal treatment of steel. Thermal treatment of aluminium and copper alloys. Chemical thermal treatment.
Preparing a seminar paper – working with text, literature review – the Internet, library.

Literature:

1. Ljiljana Trumbulović: MATERIJALI, polimeri, keramika, kompoziti, Visoka poslovno tehnička škola str.stud. Užice, 2015., ISBN 978-86-83573-64-6, COBISS.SR-ID 217942796
2. Milutinović I., Trumbulović Lj., Mašinski materijali, VTŠ, Užice, 2000. CIP 539.3/6 (075.9) ID 69988/749, 2000.
3. Ivan Milutinović, Ljiljana Trumbulović: Praktikum za vežbe iz mašinskih materijala, VTŠ Užice, 2003.
4. Ristić M.M., Osnovi nauke o materijalima, Naučna knjiga, Beograd, 1997.
5. M.Teciazić Stevanović: Osnovi tehnologije keramike, TMF Beograd, 2005. ISBN 86-7401-065-2.
6. M. Plavšić, Polimerni materijali, Naučna knjiga, Beograd, 1996.
7. M.Jovanović, D.Adamović, V.Lazić, N.Ratković: Mašinski materijali, Univerzitet u Kragujevcu Maš.fakultet U Kragujevcu, ISBN 86-80581-55-0, COBISS.SR-ID 105498380
8. B.Cvejić: Mašinski materijali, Visoka tehnička škola Uroševac, 2004., ISBN 86-7746-029-2, COBISS.SR-ID 1182563396

Number of active teaching classes: 60				Other classes:
Lectures: 30	Practical classes: 30	Other teaching forms:	Study research work:	

Teaching methods: Oral presentation (monologue), laboratory exercises

Knowledge evaluation (maximum 100 points)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	**10**	Written exam	20
Practical classes	**0**	Oral exam	30

Laboratory exercises	**10**		
Seminar papers	**30**		
Assessment methods:			

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Mathematical Modelling

Teacher: Nebojša V. Ivković

Course status: Elective

Number of ECTS: 6

Prerequisites: Mathematics 1, Mathematics 2

Course aim: Introducing students to the fundamentals of mathematical modelling and teaching them how to use mathematical models for the analysis and prediction of real-world phenomena.

Course outcomes: Students will be able to understand, create, use and use mathematical models on their own. They will learn how to interpret the results obtained using mathematical models.

Syllabus:

Theoretical instruction:

Understanding experimental research. Theory of multi-factorial planning of experiments using central compositional plans of first, second and higher order. Determining number of factors. Determining variation range and number of factor levels. Model theory (physical models, mathematical models). Linear regression models with one or two variables. Theory of multiple regression and correlation analysis. Analysis of variance (ANOVA). Correlation coefficient. Calculating parameters of mathematical models. Determining reliability limits of model parameters. Estimating significance of model parameters. Model adequacy checking. Determining reliability limits of mathematical models. Mathematical modelling of complex stochastic processes and systems using multi-factorial central compositional plans of higher order and polynomial functions. Fourier series. Mathematical modelling of dynamic processes using Fourier series. Analysis of lower and higher order harmonics.

Practical instruction:

Practical examples of mathematical modelling of stochastic processes using the available software (calculating the parameters of a mathematical model, determining the reliability limits of model parameters, estimating the significance of model parameters, model adequacy checking). Practical examples of mathematical modelling of dynamic processes using the Fourier series and analyses of harmonics using the available software.

Literature:

1. J.Stanić, Osnove matematičke teorije eksperimenata, Mašinski fakultet, Beograd, 1981.
2. N.Ivković, Izrada softvera za matematičko modeliranje složenih višefaktornih stohastičkih objekata istraživanja i njegova praktična primena, Magistarska teza, Mašinski fakultet, Beograd, 1992.
3. N. Ivković, LJ. Diković, Interpolacija racionalne funkcije sa dve nezavisne promenljive pomoću polinomijalne funkcije, First Mathematical Conference in the Republic of Srpska, University of East Sarajevo, Faculty of Philosophy, Pale, 2011
4. N. Ivković, V. Urošević, LJ. Diković, Simulacija matematičkog modeliranja trofaktornog procesa pomoću polinomijalnih funkcija, XV International conference YUINFO 2009, Conference and Exhibition, Kopaonik, Serbia, 2009
5. N. Ivković, LJ. Diković, Multifactorial Mathematical Modelling and Simulation in 2D and 3D Space Supported by Software, 12th Serbian Mathematical Congress, Novi Sad, Serbia, 2008

Number of active teaching classes: 60					Other classes:
Lectures: 30	Practical classes: 30	Other forms of instruction:	Research study:		

Teaching methods::

Demonstration, illustration, presentation, conversation.

Knowledge evaluation (maximum number of points: 100)			
Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	
Practical classes - attendance and	25	Oral exam	45

examples of practical application			
Colloquium			
Seminar papers	20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – First Degree Studies

Course title: Mathematics 1

Teacher: Ljubica Ž. Diković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Providing students with mathematical knowledge in the field of linear algebra, vector algebra and analytical geometry, which will support their study of other discipline-related courses.

Course outcomes: Students will be able to use the acquired general mathematical knowledge independently in other general and vocational courses, as the theoretical and/or practical basis.

Syllabus:

Theoretical instruction:

The concept of a determinant and its characteristics, the concept of a minor and algebraic cofactor. Methods for computing determinants. Systems of linear equations. Cramer's rule. Solution discussion. Special cases of systems of linear equations. Different types of use.

Scalar and vector quantities. Vector operations. The orthogonal projection of a vector onto an axis. Linear dependence of vectors. Conditions for collinearity and coplanarity of vectors. Vector decomposition. The scalar and vector products of vectors and their properties. The mixed product of three vectors and its properties. Using the mixed product to calculate the volume of a parallelepiped, tetrahedron and prism. Cartesian coordinate system. The rectangular Cartesian coordinate system. Orths. Cayley tables. The algebraic approach to the scalar, vector and mixed product. Different types of use.

Point. The distance between two points. The midpoint of a line. Dividing a line into segments in a given ratio. Plane. The equation of a plane perpendicular to a vector and passing through a point. The segmental form of a plane equation. The equation of a strand of a plane through the line of intersection of two planes. The distance from a point to a plane. The angle between two planes. Conditions for perpendicular and parallel planes. The intersection point of three planes. Straight line. General, vector, canonical and parametric forms of the equations of a straight line. The equation of a straight line passing through two points. The distance from a point to a plane. The angle between two straight lines. Conditions for perpendicular and parallel straight lines. The shortest distance between non-intersecting straight lines. Straight lines and planes. Different types of use.

Polynomials. Polynomial division. Zeros of polynomials and Vieta's formulas. Basu's theorem. The use of Basu's theorem.

Practical instruction:

Students perform the tasks relying upon the theoretical lectures; the theoretical knowledge is used to solve practical problems and tasks.

Literature:

1. LJ. Diković, MATEMATIKA 1, Zbirka zadataka sa elementima teorije, udžbenik broj ISBN 978-86-83573-08-0, VPTŠ Užice, 2008.
2. Marković R., Marković O., Matematika, udžbenik broj ISBN 86-80695-43-2, Učiteljski fakultet i Viša tehnička škola, Užice, 1996.
3. Nikolić O. i grupa autora, Matematika za više tehničke škole, ISBN 86-387-0610-3, Savremena administracija, Beograd 2000.
4. Sevanović, D. i grupa autora, Zbirka zadataka iz matematike za više tehničke škole, ISBN 86-387-0611-1, Savremena administracija, Beograd, 2000.

Number of active teaching classes: 60				Other classes:
Lectures:	Practical classes:	Other forms of instruction:	Research study:	

2x15=30	2x15=30			
Teaching methods: Ex cathedra, group work, interactive methods.				
Knowledge evaluation (maximum number of points 100)				
Pre-exam obligations	**Points**	**Final exam**	**Points**	
Class attendance	10	Oral exam	30	
Homework	20			
Colloquia	40			

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Mathematics 2

Teacher: Ljubica Ž. Diković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Passed exam in Mathematics 1

Course aim: Mastering the mathematical knowledge in the field of differential and integral calculus, which will serve as the basis for the study of other general and profession-related courses.

Course outcomes: Developing students' ability to use the acquired higher mathematical knowledge independently in other general and vocational courses, as the theoretical and/or practical basis.

Syllabus:

Theoretical instruction:

Functions of a real variable. Review of basic functions.

Arrays. Boundary values of an array.

Boundary values of functions. Left-hand and right-hand boundary values of functions. Infinitely small and infinitely large functions. Continuity of a function at a point and over an interval. Some important limits.

Derivatives of functions. Derivative of the sum, difference, product and quotient of two functions. Geometric definition of a derivative. Kinematic definition of a dervative. Equations of the tangent and normal to a curve. Derivative of a complex function. Differential of a function. Applying a differential to approximate calculations of functions. Relationship between derivative and differential. Derivatives and higher order differentials. Roll's, Lagrange's and Cauchy's theorem. L'Hôpital's rule. Using derivatives for further study of graphs and flows of functions. Extreme values of functions. Inflection points. Convex and concave.

Indefinite integrals. Difference between differential and integral calculus. Decomposition method. Replacement method. Method of integration by parts. Recursive formulas. Integration of rational functions.Integration of trigonometric functions. Definite integrals. Newton-Leibniz formula. Methods of calculating specific integrals. Improper integrals. Using specific integrals to calculate the surface area of a flat figure and to detrmine the arc length. Examples of use in a specific field of study. First-order differential equations.

Practical instruction:

Students perform the tasks relying upon the theoretical lectures; the theoretical knowledge is used to solve practical problems and tasks.

Literature:

1. Marković R., Marković O., Matematika, udžbenik broj ISBN 86-80695-43-2, Učiteljski fakultet i Viša tehnička škola, Užice, 1996.
2. Ljaško I. i grupa autora, Zbirka zadataka iz matematičke analize, Naša knjiga, Beograd, 2007.
3. Novaković M. i grupa autora, Zbirka rešenih zadataka iz matematičke analize 1, ISBN 978-86-7892-320-3, FTS, Novi Sad, 2011

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of teaching:	Research study:	

Teaching methods: Ex cathedra, group work, interactive methods.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Class attendance	10	Oral exam	30
Colloquia	40		
Homework	20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Mechanics

Teacher: Dragiša D. Mićić

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Students master the principles of classical Newtonian mechanics.

Course outcomes: By mastering mechanics, students acquire the necessary foundation for successful studying of other mechanics-related courses (Resistance of Materials, Machine elements, etc.).

Syllabus:

Theoretical instruction:

STATICS: Subject of study. Axioms of statics. Mechanical binding and binding reactions. Force. Sum of forces in plane or space. Types of systems of forces in plane and space. Moment of force and concurrent forces. Main vector, main moment. Conditions for equilibrium of forces. Flat bearers and their types. Static diagrams (axial forces, transversal forces, pitching moment). Lattice bearers and calculation methods. Rolling friction, sliding friction and rope friction.

KINEMATICS: Subject of study. Kinematics of points: motion of points. Trajectory of point, speed and acceleration depending on method of determining motion of point. Straight-line and curved uniform and non-uniform motion. Harmonious oscillations. Diagrams of motion of points. Absolute and relative motion. Kinematics of rigid bodies. Rotation around fixed axis. Motion in a straight line. Current direction of rotation (current rotation, speed and acceleration). Speed and acceleration plan along straight line. Mechanisms: piston and coulisse mechanism.

DYNAMICS: Subject of study. Newton's laws. Basic rasks in dynamics: the force is given and motion is to be determined; motion is given and the force is to be determined. Lof a point - laws and theorems. Fixed material point. D'Alambert's principle.

Practical instruction:

There is no practical instruction.

Computational tasks: Performing tasks relating to theoretical instruction. Graphical assignments – calculation (homework): 1. Bonds and binding reactions. 2. Static diagrams of flat carriers. 3. Static diagrams of shafts in space.

Literature:

1. Velibor Jovanović, Mehanika-Statika, VPTŠ, Užice, 2005.
2. Velibor Jovanović, Mehanika – kinematika i dinamika sa urađenim zadacima, VPTŠ, Užice, 2001.
3. Velibor Jovanović, Statika – zbirka rešenih zadataka, VTŠ Užice, 1996.
4. Lazar Rusov, Statika, Privredni pregled, Beograd.
5. Dragan I. Milosavljević, Kinematika, Kragujevac.
6. Miloš Kojić, Dinamika (Teorija i primeri), Naučna knjiga, Beograd.

Number of active teaching classes: 75				Other classes:
Lectures: 3*15=45	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Audio-visual; board and chalk

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Attendance at lectures	10	Written exam	20
Attendance at practical classes	10	Oral exam	30
Activity during lectures and practical classes	10		
Graphical assignments	20		

Study programme: Mechanical Engineering

Type and Level of Studies: Undergraduate Vocational Studies

Course code and title: Occupational Safety

Teacher (Surname, middle initial, name): Marjanović M. Vesna

Course status: Elective

Number of ECTS credits: 6

Prerequisites: no

Course aims: Introducing students to the provisions of the Law on Occupational Safety and Health. Acquainting them with the most important dangers and hazards that can occur when performing tasks of specific jobs and the measures and means of protection that need to be implemented and applied so that the level of risk of injuries and health impairment is reduced and maintained at an acceptable level.

Learning outcomes: Knowledge of national regulations relating to occupational safety and health. The ability to identify hazards and dangers in the workplace, and by taking appropriate occupational safety and health measures, prevent, eliminate and reduce the risk of perceived dangers and hazards. Mastering occupational safety and health measures while performing tasks of specific jobs. Ability to plan and implement occupational safety and health measures while performing tasks of specific jobs.

Syllabus

Theoretical instruction: Introduction to occupational safety (concept, subject and historical development of occcupational safety). Legal framework for occupational safety and health (International law, National regulations: the Constitution of the Republic of Serbia, Law on Occpational Safety and Health). Work-related injuries, occupational ailments and work-related illnesses. Basic sources and causes of hazards and injuries at work: a) subjective causes, b) objective causes. Types and characteristics of harmful effects (harmul effects caused by psychic and psycho-physiological efforts, harmful effects related to the organization of work, harmful effects caused by other people, harmful effects caused by or arising in the process of work: physical (noise and vibrations), harmful effects of radiation (thermal, ionizing or non-ionizing, laser, ultrasonic), adverse effects of microclimate (temperature, humidity and air flow rate), inappropriate lighting, chemical hazards, dust and fumes, harmful effects caused by the use of dangerous materials and hazards (mechanical hazards occurring while using work equipment, hazards associated with workplace characteristics, hazards arising from the use of electricity; fire and explosion hazards) in the workplace and work environment, and means of protection. General and specific measures in the field of occupational health and safety (for the manual transmission of cargo, for transport and maintenance of different means of transport, for exposure to vibration and noise).

Practical teaching: Auditory and demonstration activities performed in specific business organisations where students can see practical examples of good and poorly organized occupational safety and health systems.

Basic characteristics of OHSAS 18001, 2007.

Literature:

1. B. Anđelković, Uvod u zaštitu, Fakultet zaštite na radu, Niš, 2005.

2. A. Ian Glendon, Sharon Clarke, Eugene McKenna, Human Safety and Risk Management, Second Edition (2006) ISBN 9780849330902

3. Zakon o bezbednosti i zdravlju na radu („Sl.Glasnik RS“, br.101/05 i 91/15).

4. Drobnjak R. i grupa autora, Bezbednost i zdravlje na radu (knjige 1 do 6) za studente Visoke poslovno-tehničke škole strukovnih studija Užice, VPTŠ, TEMPUS JPHES 158781, 2010-2012.

Number of active teaching classes: 60				Other classes:
Lectures: 30	Practical classes: 30	Other teaching forms:	Study research work:	

Teaching methods: Dialogue, monologue, demonstration of practical work, work with text, literature review.

Knowledge evaluation (maximum 100 points)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	**10**	Written exam	50
Practical classes	**10**	Oral exam	
Colloquia	**20**		
Seminar papers	**10**		

Assessment methods:

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Physics

Teacher: Miloje S. Ćetković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Introducing students to fundamental natural laws and metrological processing of measurement results, as well as to multidisciplinary approach to environmental protection issues.

Course outcomes: Students develop analytical skills necessary for the successful application of fundamental natural laws, as well as for understanding and solving simple versions of different engineering issues. Development of critical and self-critical thinking. Acquiring thorough knowledge about physical sources of pollution and environmental protection measures.

Syllabus:

Theoretical instruction:

Position and role of physics and its influence on development of technical sciences. Kynematics and dynamics of a material point, rotation dynamics. Work, power, energy, laws on conservation of energy, collision theories. Garvity. Elasticity of rigid bodies. Mechanic oscullations, waves, sound. Noise. Protection from noise in the environment. Statics, fluid dynamics, surplus stress and capillarity, viscosity and viscous fluid flow. Thermal spreading, calorimetry and phase transitions. Molecular-kynetic theory. Themo-dynamics. Heat spreding. Electrostatical power, electic field. Laws of geometric optics, optical instruments. Photometry. Wave optics, stimulated radiation. Quantum nature of electromagnetic radiation. Wave properties of particles. Bohr's theory. X-radiation. Heisenberg's uncertainty principle. Atomic nucleus. Mass defect and nuclear binding energy. Radioactivity. Nuclear reactions.

Practical instruction:

Determining density. Determining surface stress. Determining modulus of elasticity. Determining acceleration of gravity. Determining torsional modulus. Testing gas laws. Determining specific heats of solids. Ohm's law and circuit. Determining focal length of lenses. Determining wavelength of light. Gamma ray absorption.

Literature:

1. V. Vučić, D. Ivanović, Fizika I, II, III, Građevinska knjiga
2. M.Arsin, M. Ćuk, S. Milojević, M. Miloradović, J.Purić, Z. Radivojević, D. Radivojević, M. Savković, P. Todorov, Ž. Topolac, Fizika za više škole, Savremena administracija
3. M. Ćetković, Praktikum računskih i laboratorijskih vežbanja iz fizike, Priboj, 2013.
4. D. Pavlović, Praktikum računskih vežbanja iz fizike, Naučna knjiga
5. V. Vučić, et al. Osnovna merenja u fizici, Naučna knjiga
6. V. Georgijević, Tehnička fizika, Zavod za izdavanje udžbenika i nastavna sredstva
7. Grupa autora, Bezbednost i zdravlje na radu, knjiga I, mdul 1, Užice, 2011.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Oral presentation, combined with graphical and computational methods. Laboratory activities. Seminar papers. Ex cathedra, group and individual work.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	7	Written exam	
Practical classes	8	Oral exam	40
Colloquia (2x10)	35		
Seminar papers	10		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Pumps, Compressors and Fans

Teacher: Aćimović M. Dragomir

Course status: Elective

Number of ECTS: 6

Prerequisites: none

Course aim: Students acquire theoretical knowledge, as well as knowledge about the construction, use and maintenance of pumps, compressors and fans.

Course outcomes: By passing the exam, students become able to select, use and maintain pumps, compressors and fans.

Syllabus:

Theoretical instruction:

Introduction – working fluid. Air – properties, compression processes, use Liquids – properties, use. Pumps – types, construction characteristics, stress, power, degree of exploitation. Compressors (special emphasis is placed on screw compressors) – construction and elements, capacity, power, pressure degrees, determining capacity according to work mode of pneumatic szstem (consumer). Fans – use, types, construction, calculations. Presentation of designed pumps, compressors and fans. Safety, hazards and protection measures when using pumps, compressors and fans..

Practical instruction:

Tasks relating to designing, selection and use of pumps, compressors and fans. Laboratory exercises relating to pumps, compressors and fans. Multimedia presentations of the given types of equipment. Laboratory exercises relating to equipment types used in plants. Preparation and review of designed projects.

Literature:

1. Protić, Z., Nedeljković, M., Pumpe i ventilatori, mašinski fakultet, Beograd.
2. Kovačević, A., Stošić, N., Smith I., Screw Compressors, Springer-Verlag, Berlin, 2007.
3. Delalić, S., Buljubašić, I., Pumpe, ventilatori, kompresori, Mašinski fakultet, Tuzla, 2007.
4. Drndarević, D., Kompresorska postrojenja, skripta, VPTŠ Užice, 2004.
5. Bogner, M., Popović, O., Kompresorska postrojenja, Interklima, V. Banja, 2008.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Work with text, 4 Case studies, brochures, instructions and other demonstration materials, 5 Laboratory work

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	40
Practical classes	20	Oral exam	-
Colloquia	10		
Seminar papers	30		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – First Degree Studies

Course title: Quality Measurement and Control

Teacher: Vidojević V. Dejan

Course status: Compulsory

Number of ECTS: 6

Prerequisites: In compliance with the Law on Higher Education and the Statute of the college

Course aim: Raising students' awareness of the importance and role of quality control in a company and its influence on product positioning.

Course outcomes: Introducing students to measurement and control methods and techniques. Teaching them how to select and use relevant measurement scales, instruments, devices or machines for quality measurement and control, as well as relevant measurement/control methods.

Syllabus:

Theoretical instruction:

The importance of product quality measurement and control. Measured and controlled values. Measurement and control errors. Selection of scales and technological card of measurement and control. Measurement and control of lengths, angles, positions, coils and gears. Measurement and control of rotation and surface roughness. Static quality control. Student's t-distribution. Gaussian distribution. Selection of measurement or control system.

Practical instruction:

Selection of scale and technological card of measurement and control. Measurement and control of length using mechanical and optical single-axis measurement instruments Measurement and control of length using pneumatic electronic single-axis measurement instruments. Measurement and control of length using dual-axis and triple-axis measurement instruments. Measurement and control of angles using single-axis and dual-axis measurement instruments. Measurement and control of coils and gears. Measurement and control of position and rotation. Measurement and control of surface roughness. Student's t-distribution. Gaussian distribution.

Literature:

1. Šotra V., Merenje i kontrola, Skripta, VTŠ; Novi Beogrda, 2007.
2. Popović B., Merenje i kontrola geometrije proizvoda, Naučna knjiga, Beograd, 1986.
3. Lazić M., Osnove metrologije, Mašinski fakultet u Kragujevcu, 1987.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods: Verbal: lectures, interactive methods. Visual: demonstration, illustration, presentation. Practical: laboratory, experimental and computer-based activities.

Knowledge evaluation (maximum number of points 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	0-10	Written exam	0-20
Practical classes	0-30	Oral exam	40
Colloquia	part of exam		
Seminar paper	0-20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Mechanics

Teacher: Dragiša D. Mićić

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Students master the principles of deformable object mechanics.

Course outcomes: Student acquire knowledge about the resistance of materials. They learn about different types of strain and deformation, about their mathematical descriptions. They can calculate load capacity, dimensions, and check stress in certain load carriers.

Syllabus:

Theoretical instruction:

Subject of study. Load and deformation types. Internal forces and stress. Deformation measurements. Axial deformation. Influence of object's own weight and temperature on axial deformation. Statically undetermined tasks. Motion plan. Stresses on inclined sections. Plane stress state. Mohr's circle. Relationship between shear modulus and elastic modulus. Shearing deformation. Geometry of cross section. Steiner's theorem. Mohr's circle and ellipse of inertia. Twisting (torsion). Dimensioning light shafts with torsion loads. Bending. Pure bending. Bending by force. Reinforced shafts with bending loads. Inclined bending. Bending at an angle. Elastic line. Console, beam. Klesh's process. Statical undetermination. Lagrange's and Kastiliane's deformation theorem. Using defromation methods to solve statically undetermined systems. Force method. Complex stresses. Excentric pressure. Deflection. Euler hyperbolas, omega function and Tetmajer formula.

Practical instruction:

Computational tasks comply with theoretical instruction.

Seminar paper/Graphical assignments:

1. Cross-sectional properties: Mohr's circle, ellipse of inertia
2. Dimensioning shafts of different cross sections with different bending loads.
3. Calculation of statically undetermined shafts using elastic line tables.

Literature:

1. D. Rašković, Otpornost materijala, Naučna knjiga, Beograd.
2. Miloš Kojić i dragan Golubović, Otpornost materijala, Naučna knjiga, Beograd.
3. Milan martinović, Otpornost materijala, VTŠ Užice, Tablice JUS i DIN
4. M. Baić, K. Jojić, Priručnik iz otpornosti materijala, Mašinski fakultet, Beograd.

Number of active teaching classes: 90				Other classes:
Lectures: 3*15=45	Practical classes: 3*15=45	Other forms of instruction:	Research study:	

Teaching methods: Audio-visual; board and chalk

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Attendance at lectures	10	Written exam	20
Attendance at practical classes	10	Oral exam	30
Activity during lectures and practical classes	10		
Seminar papers/Graphical assignments	20		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Russian 1

Teacher: Terzić V. Svetlana

Course status: Elective

Number of ECTS: 6

Prerequisites: None

Course aim: Teaching students how to use specialized literature relating to a specific vocational area; developing students' language skills (reading, translation, conversation); combining lexical and grammatical structures. Developing reading comprehension skills and teaching students how to use bilingual technical dictionaries. Developing text analysis skills, as well as precise and concise communication skills. Increasing public awareness of the importance of being familiar with fundamental concepts of mechanical engineering using discipline-related texts.

Course outcomes: Providing continuous foreign language education upon high school completion. Developing communication skills and the skills that will enable students to cooperate with the immediate social and international environment. Acquiring knowledge and developing skills necessary for the successful use of the Russian language for the purpose of keeping pace with latest innovations and using them in practice. Students master vocabulary for specific purposes, can use specialized literature and can communicate successfully in Russian. Special emphasis is placed on using the information available on the Internet. Students use specialized literature to prepare final theses.
Students use Russian successfully in oral and written communication in every-day situations.

Syllabus:

Theoretical instruction:
The syllabus is divided into two, mutually interrelated parts. The first one comprises LSP texts, which will introduce students to specific vocabulary relating to mechanical engineering They will use this vocabulary in speaking activities about vocation-related topics. The other part comprises phonetics and grammar, necessary for developing reading comprehension skills, as well as listening comprehension skills. As for phonetics, special attention is paid to the correct pronunciation of soft consonants and iotified vowels. As for grammar, students will learn types of nouns, comparison of adjectives, numbers, and verbs of movement.

Practical instruction:
Students master language for specific purposes though translation of texts and conversation about topics relating to mechanical engineering.

Literature:

1. Marojević, Radmilo, 1983, Gramatika ruskog jezika, Beograd, Zavod za udžbenike i nastavna sredstva
2. Piper, Predrag, Gramatika ruskog jeyika, Yavet, Beograd, 2005.
3. Partina A.S. Архитектурные термины, Стройиздат, Moskva, 1994.

Number of active teaching classes: 30				Other classes:
Lectures: 2x15=30	Practical classes: 0	Other forms of instruction:	Research study:	

Teaching methods: Monologue and dialogue.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points: 70**	**Final exam**	**Points: 30**
Activity during lectures	10	-	-
Practical classes	-	Oral exam	30
Colloquia	60	-	-
Seminar papers	-	-	-

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Russian 2

Teacher: Terzić V. Svetlana

Course status: Elective

Number of ECTS: 6

Prerequisites: Passed examination in Russian 1.

Course aim: Teaching students how to use specialized literature relating to a specific scientific discipline; developing students' language skills (reading, translation, conversation); combining lexical and grammatical structures. Increasing public awareness of the importance of mechanical engineering using specialized texts.

Course outcomes: Students can use the Russian language successfully. They will develop communication skills that will enable them to cooperate with the immediate social and international environment.

Syllabus:

Theoretical instruction:

The syllabus is divided into two, mutually interrelated parts. The first one comprises LSP texts, which will introduce students to specific vocabulary relating to mechanical engineering They will use this vocabulary in speaking activities about vocation-related topics. The other part comprises phonetics and grammar, necessary for developing reading comprehension skills, as well as listening comprehension skills. As for phonetics, special attention is paid to the correct pronunciation of soft consonants and iotified vowels. As for grammar, students will learn about adverbs, imperative, participles.

Practical classes:

Listening exercises to practise coping with unfamiliar situations, using specific, technical vocabulary. Talking about topics relating to mechanical engineering.

Literature:

1. Marojević, Radmilo, 1983, Gramatika ruskog jezika, Beograd, Zavod za udžbenike i nastavna sredstva
2. Piper, Predrag, Gramatika ruskog jeyika, Yavet, Beograd, 2005.
3. Столяровский С.: Arhicad 11,Учебный курс,Питер (изд.) 2008

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods: Monologue and dialogue-based methods.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points: 70**	**Final exam**	**Points: 30**
Active participation during lectures	10		-
Practical classes		Oral exam	30
Colloquia	60	-	-
Seminar papers		-	-

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies

Course title: Technical Drawing and Descriptive Geometry

Teacher: Milivojević S. Milovan

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Done practical exercises and passed 2 colloquia in Descriptive Geometry, as well as done practical exercises and a project assignment in Technical Drawing.

Course aim:

Teaching students how to use computer-aided descriptive geometry methods and rules of technical drawing relating to mechanical engineering

Course outcomes:

Students will be trained to prepare technical documentation relating to mechanical engineering on their own.

Syllabus:

Theoretical instruction:

Orthogonal projection. Projection of point. Intersection of straight line and projection plane. Plane and traces of plane. Intersection of two planes. Parallel lines (horizontal, frontal and profile) and their use. Projection of planes. Geometric shapes in axonometric position. Rotation. Transformation. Determining actual length of a straight line. Determining actual size of images on planes. Inclined planes. Intersection of straight line and plane. Lines perpendicular to planes. Intersection of plane and object whose base is in a projection plane. Intersection of object whose base is in plane and determining projection of intersection. Actual size of intersections and object networks. Using descriptive geometry methods in mechanical engineering. Designing and mechanical engineering. CAD, 2D and 3D designing. Elements of computer graphics. Translation scaling, rotation matrices. Software support (e.g. AutoCAD, Solid Works, CATIA, etc.). Examples. Hardware. Standards (SRPS, DIN, etc.). Heading formats and norms. Types of lines. Technical script. Circular transitions, contours, spirals, cycloids, spline, etc. Main layouts. Standard orthogonal views. Creating projections when axonometric layout of object is familiar. Creating axonometric layout when part with two orthogonal projections is familiar. Measuring and dimensioning. Elements of dimensioning. Dimensioning of length, angle, diameter, square, sphere, tendon and arch, dimensioning of inclination and cone. Parallel dimensioning. Progressive dimensioning. Dimensioning starting from base plane and combined dimensioning. Dimensioning simplification. Special views. Cross sections: full, half, cross section with several parallel lines, intricate cross section, partial cross section. Processing methods and surface roughness. Dimension, shape and position tolerance. Matching and overlapping. Presentation in technical documentation: screws, thread systems, different types of gears, cones, welded joints, springs, tins, etc. Example: designing shafts. Workshop drawing of machine parts. Designation of steel and other materials in machine engineering. Assembly drawing. Cross section of assemblies. Joints. Preparation and update of technical documentation. Archiving.

Practical instruction:

Descriptive geometry – through practical activities, students master descriptive geometry methods used in mechanical engineering. Based on given examples and with professor's assistance, each student is required to do ten homework assignments in pencil on A3 paper format and defend them.

Technical drawing – students develop practical skills relating to the theory about technical drawing and design in machine engineering presented during lectures. Each student is required to do 10 assignments in CAD computer laboratory using a selected software package (AutoCAD, SolidWorks, etc.). Each student is also required to do a project assignment (an assembly drawing with proper technical documentation for a given topic) and defend it at the end of the semester.

Literature:

1. Radosavljević, D., Sokić, M., Praktikum za vežbe iz teorijskog crtanja sa teorijskim osnovama AutoCAD 2D, COBISS –SR-ID 100604172, ISBN-86-7746-056-X, Niš, Sven, 2005.
2. T. Pantelić, Tehničko ctranje, Građevinska knjiga, Beograd, 1985.
3. S. Bogoluubov, EXERCISES IN MACHINE DRAWINGS, MIR, PUBLISHERS, MOSCOW,1989
4. Alan j. Kalameja AutoCAD 2004 za inženjere mašinstva, Kompjuter biblioteka, 2005.
5. SRPS and DIN mechnanical engineering standards
6. Đorđević, S., Petrović, D., Inženjerska grafika, Praktikum za vežbe, Mašinski fakultet, Beograd, 2009

Number of active teaching classes: 75	Lectures: **15x2=30**	Practical classes: **15x3=45**

Teaching methods: 1. Ex cathedra presentation with specific demonstration of examples on the board (descriptive geometry) or using the selected software packages, such as AutoCAD, SolidWorks, etc. (technical drawing). Development of skills through practical work in CAD computer laboratory using the selected software packages, such as AutoCAD, SolidWorks, etc. for the given topics, together with strong peer-to-peer assistance.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	5	Practical work using CAD	20

		software package	
Practical classes	20	Oral exam	0
Colloquium	25		
Seminar paper	30		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Thermal Power Plants

Teacher: Damnjan D. Radosavljević

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Students will master basic concepts relating to the analysis of technological schemes of thermal power plants, as well as their cost-effectiveness indicators within a larger energetic system. Furthermore, students acquire knowledge required for further research in this field.

Course outcomes: Students develop clear understanding of specificities of certain constructive solutions regarding the selection of the location, preparation of the general construction plan of a thermal power plant and its adjustment to the environment, taking sustainable development into consideration, as well as environmental acceptability.

Syllabus:

Theoretical instruction:

Introduction: types of energy, energy transformation and classification. Boiler plants. Characteristics of burners and their use. Ensuring conditions for boiler plant exploitation. Generating hot water and steam. Boiler plant ancillary equipment. Indicators of thermal cost-effectiveness of thermal plants. Steam boiler parametres and overheating. Regenerative heating of feed water. Steam, water and condensate losses. Supplying thermal power plants with water. Fuel trasnportation and storage. Slag and ash transportation. Filtration and release of smoke from a thermal power plant into the atmosphere. Location and general plan of a thermal power plant. Fundamentals of the preparation of the general plan of a thermal power plant. Designing thermal calculation schemes. Basic thermal equipment of a turbine power plant. Thermal power plant exploitation problems. Industrial thermal power plants. Terotechnology and maintenance of power plants. Repairing and regeneration of thermal power plants.

Practical instruction:

Designing a power plant, designing the pipework. Students visit thermal power plants in Serbia in order to become familiar with work processes and maintenance methods. Taking students to mechanical facilities producing parts and equipment in order to introduce them to these production processes.

Literature:

1. Požar, H., Osnovi energetike I i II, Zagreb, 1976.
2. Bogner, M., Termotehničar I i II, Beograd, 1992.
3. Nikolić, S., Termoenergetska postrojenja u parcijalnoj i kompleksnoj primeni, Beograd, 1991.
4. Brkić, Lj., Đivanović, T., Tucaković, D., Termoelektrane, Mašinski fakultet, Beograd, 2006.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Lectures, auditory and graphical exercises. Independent preparation and presentation of a seminar paper. By visiting power plants, students will become familiar with their construction and exploitation.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	Up to 10	Written exam	
Graphical assignment or seminar paper	Up to 20	Oral exam	40
Colloquia	Up to 30		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Thermodynamics and Heat Devices

Teacher: Damnjan D. Radosavljević, Vesna M. Marjanović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Providing students with fundamental knowledge on thermodynamics and heat devices frequently used in process technique and thermo-mechanics. The programme is design so as to introduce students to thermal energy transformation from the practical point of view, through lectures and practical classes.

Course outcomes: Having passed the exam, students become competent to do certain calculations on their own and follow the instruction in other courses relating to thermo-mechanics successfully.

Syllabus:

Theoretical instruction:

Fndamental physical concepts (matter, energy, qualitatively different types of energy, mass, substance and physical field, substance quantity). Macroscopic material system. First thermidynamics postulate. Basic concepts of thermodynamics. Temperature. Ideal and semi-ideal gas. Fundamental gas laws. First and second form of the first principle of thermodynamics for a closed thermodynamic system. Thermal capacity of substances. Basic, seemingly balanced changes of the state of ideal gas. Liquid cooling. Circular changes of state. Humid air. Heat transfer methods. Heat transfer by radiation. Heat exchangers.

Practical instruction:

Solving typical problems relating to the theoretical subject matter presented during lectures. Theoretical and professional explanations, comments and analyses of the solutions are provided, with active engagement of students. Students perform two tasks on their own, one relating to thermal capacity and gas equilibrium, and the other relating to humid air and heat transmission methods.

Literature:

1. Milinčić, D., Voronjec, D., Termodinamika, Mašinski fakultet, Beograd, 2000.
2. Jaćimović, B., Genić, S., Toplotne operacije i aparati, Mašinski fakultet, Beograd, 1992.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: The course is delivered through lectures, practical classes and consultations. Lectures imply oral presentation of the theoretical part of heat and mass transfer, with the analytical approach and explanation of practical applications. During practical classes students are actively engaged in numerical tasks.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Colloquia	20	Written exam	30
Instruction	10	Oral exam	30
Independent assignments (2)	20		
Laboratory exercises	-		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Tools and Equipment

Teacher: Slobodan M. Petrović

Course status: Elective

Number of ECTS: 6

Prerequisites: None

Course aim: The aim of the course is to teach students how to design and use cutting and deformation tools, as auxiliary equipment.

Course outcomes: Upon the completion of this course, students will be able to select, design and use tools and equipment.

Syllabus:

Theoretical instruction:

Auxiliary tools – introduction, clasification, tools for basing. Clamping tools, tools for determining position and tool guiding. Determining the precision of auxiliary tools. Total processing failure. Mechanised clamping systems. Cutting tools. Cutting tool materials. Construction characteristics. Scraping tools. Profile scrapers. Hole processing tools. Milling tools. Thread cutting tools. Gear cutting tools. Dragging tools. Grinding tools. NUMA tools. Bending tools. Pulling tools. Forging with presses. Brim cutters and bottom piercing tools. Tool materials, production methods and utilisation. Pressure casting tools. Plastic pressing tools. Safety and protection measures when using the above-mentioned tools and equipment.

Practical instruction:

Tasks relating to auxiliary equipment. Tasks relating to cutting tools. Laboratory exercises relating to cutting tools. Tasks relating to tin processing tools. Tasks relating to forging tools. Tasks relating to pressure casting tools. Tasks relating to plastics pressing tools. Multimedia presentations of the mentioned tools. Laboratory exercises relating to the mentioned tools in factories. Project review.

Literature:

1. Tanović, Lj., Jovičić, M., Alati i pribori – projektovanje, proračuni i konstrukcije pomoćnih pribora, II izdanje, Mašinski fakultet, Beograd, 2015.
2. Tanović, Lj., Jovičić, M., Alati i pribori –proračuni i konstrukcije alata za izradu delova od lima, III izdanje, Mašinski fakultet, Beograd, 2015.
3. Tadić Branko, Alati i pribori – skripta, Univerzitet u Kragujevcu, Mašinski fakultet, Kragujevac, 2008.
4. Drndarević Dragoljub, Alati i pribori – priručnik, Visoka poslovno-tehnička škola, Užice, 2015.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Work with text, 4 Case studies, brochures, instructions and other demonstration materials, 5 Laboratory work

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	5	Written exam	30
Practical classes	5	Oral exam	-
Colloquia	30		
Seminar papers	30		

Study programme: Mechanical Engineering

Type and level of studies: Undergraduate Vocational Studies – first degree studies

Course title: Wood Processing Machines and Tools

Teacher: Slobodan M. Petrović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Students acquire knowledge about machines and tools used in wood processing industry and develop necessary competencies.

Course outcomes: Teaching students how to solve problems relating to exploiting opportunities, work methods and use of machines and cutting tools in wood processing industry.

Syllabus:

Theoretical instruction:

Classification of wood processing machines and cutting tools, cutting theory. Specific cutting resistance, specific cutting operation, curring power and cutting force. Factors affecting specific cutting resistance. Tool materials. Types of tools. Steadiness of tools. General tool designing principles. Preparing cuting tools for wood processing. Characteristics of wood processing machine systems. Elements and mechanisms of wood processing machines. Tool positioning and assembly. Wood cutting machines and tools: splitting, grinding, grating, chipping, drilling, milling, chopping, cutting through, cutting off and piercing. Wood deformation machines.

Practical instruction:

Students will have practical classes in companies in order to introduce them to the operations of machines for the preparation of wood, maintenance of cutting tools and machines in primary and final wood processing.

Other forms of teaching – laboratory exercises:

Complex wood processing methods. Learning about cutting resistance and factors affecting it. Wood suitability for processing and main processing factors. Becoming familiar with machine parts. Classification of wood cutting tools. Cutting tools sharpening devices. Machine elements and parts. Transmitters. Machine positioning. Wood cutting machines and tools: splitting, grinding, grating, chipping, drilling, milling, chopping, cutting through, cutting off and piercing. Wood deformation machines.

Literature:

1. Kršljak Bogoljub, Mašine i alati za obradu drveta I i II, Šumarski fakultet, Beograd, 2002.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3 Preparation of seminar papers and discussion about it, 4 Case studies, brochures, instructions and other demonstration materials, 5 Practical assignment

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	5	Written exam	30
Practical classes	5	Oral exam	
Colloquia	30		
Seminar paper	30		